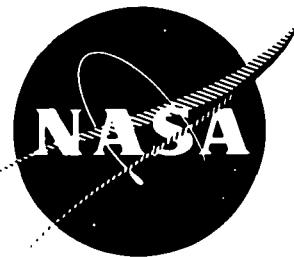


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OR 12,643



**REGISTER OF SPECIALIZED SOURCES
FOR INFORMATION ON
MECHANICS OF STRUCTURAL FAILURE**

By James L. Carpenter, Jr., and Frank J. Denny

**MARTIN MARIETTA AEROSPACE
Orlando, Florida 32805**

**CASE FILE
COPY**

prepared for

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER
AEROSPACE SAFETY RESEARCH AND DATA INSTITUTE
CLEVELAND, OHIO 44135**

**Patrick T. Chiarito, Project Manager
George Mandel, Technical Adviser**

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16. Abstract This <u>Register</u> lists alphabetically twenty-two specialized information sources that generate information relative to six problem areas in aerospace mechanics of structural failure. Selection for inclusion was based upon information obtained from the individual knowledge and professional contacts of Martin Marietta Aerospace staff members and the information uncovered by the staff of technical reviewers. Activities listed perform basic or applied research related to the mechanics of structural failure and publish the results of such research. The purpose of the register is to present, in easy reference form, original sources for dependable information regarding failure modes and mechanisms of aerospace structures.			
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FOREWORD

This Register lists alphabetically those specialized information sources that generate information relative to the six problem areas listed in the introduction. In most cases the information listed was obtained directly from the source described. In some cases the information was not considered complete; updating is contemplated.

The purpose of this publication is to present, in easy reference form, original sources for dependable information regarding failure modes and mechanisms of aerospace structures. The specialized information sources could be queried by researchers in similar fields of research or development work for unpublished information and more of the details which have not appeared in published reports, journal articles, or society presentations. In addition, further inquiries could be made regarding active ongoing projects where the published results may not appear for several months. No attempt was made to ascertain that information sources listed are actually available for extensive consultation. This is left to negotiation between the parties involved.

Selection for inclusion was based upon information obtained from the individual knowledge and professional contacts of Martin Marietta Aerospace staff members and the information uncovered by the staff of technical reviewers. Activities listed perform basic and applied research related to the mechanics of structural failure and publish the results of such research. This is recognized as being an incomplete listing and represents only an initial installment. Nevertheless, it is hoped that it will contribute as a guide to those who seek related information. Candidates for a revised register are encouraged.

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INTRODUCTION

The Register of Specialized Sources For Information on The Mechanics of Structural Failure contains pertinent information on organizations who generate data through the performance of research on the six problem areas listed below.

- I. Life prediction of materials at high temperatures and exposed to monotonic and cyclic loading - Includes information on low cycle and thermal fatigue particularly as it applies to turbine buckets in the gas turbine engine, and high cycle fatigue data for materials used in components such as engine bearings.
- II. Fracture toughness data on various structural materials - Available data are categorized with respect to test methods, K_{Ic} versus K_c , and other peculiar parameters considered by the investigators. In particular, data derived from ASTM standard tests are identified.
- III. Fracture mechanics analyses - capabilities and limitations - A significant amount of publications deal with linear elastic fracture mechanics which assumes plane strain. Attempts were made to identify any work that was done, taking into account elastic-plastic theories.
- IV. Hydrogen embrittlement of superalloys - This subject is of interest regarding turbine buckets, which are exposed to high temperatures. It will be of increasing importance if additional interest develops in using hydrogen as the fuel in gas turbine engines.
- V. Protective coatings - Airbreathing engines operating in contaminated environments are in need of protection against attack by the contaminants. Information on the various candidate coatings and the effects of combustion products of contaminants in jet fuels on engine components is of prime interest. For example, the sulfur ordinarily contained in JP fuels reacts with salt present in shipboard and offshore environments and the resulting compounds attack turbine buckets severely.
- VI. Composite materials data on low cycle and thermal fatigue - Our aim here is to search for data related to composite structural materials.

Information Source:

Air Force Machinability Data Center
Metcut Research Associates, Inc.
3980 Rosslyn Drive
Cincinnati, Ohio 45209
Phone: (513) 271-5100

Individual Contact(s):

Dr. Michael Field - President, Metcut Research Associates
Dr. John F. Kahles - Vice President, Metcut Research Assoc.;
 Director AF Machinability Data Center
Dr. William P. Kester - Vice President, Metcut Research Associates

Activities:

Metcut performs basic research on the prediction of materials behavior due to machining, e.g., surface integrity, creep, fatigue, etc. The Data Center maintains all documentation.

Holdings:

The Data Center maintains about 35,000 documents (journals, articles, technical and scientific data, technical reports, etc.) pertaining to the machining and machinability of materials, primarily metals.

Publications:

Technical reports; contract bibliographies and specialized listings.

Information Services:

Provides detailed answers to technical queries and prepares bibliographies for a fee.

Remarks:

The Center is operated by Metcut Research Associates, Inc., for the Air Force Materials Laboratory, Manufacturing Technology Division. It collects, evaluates, stores, and disseminates material-removal information, including detailed machining data. Data Center records are also available from DDC.

Information Source:

Applied Physics Laboratory
Johns Hopkins University
8621 Georgia Avenue
Silver Spring, Maryland 20910
Phone: (301) 589-7700

Individual Contact(s):

Dr. Ralph E. Gibson - Director
Richard A. Evans - Librarian

Activities:

Performs basic and applied research in structural mechanics, solid state physics, fluid mechanics, propulsion and electronic sciences. Maintains propulsion, analog computer, high temperature hydraulics and inertial research laboratories, computing and data processing centers, satellite injection and tracking stations, a radome and antenna testing facility, and a hypersonic wind tunnel.

Holdings:

Maintains a library of 40,000 volumes on aerodynamics, automation, chemistry, electronics, engineering, geophysics, mathematics, physics, and propulsion.

Publications:

Research results usually contained in classified progress reports to sponsor and, when unclassified, published in scientific and engineering journals, monographs, and bulletins. Publications: APL TECHNICAL DIGEST (bi-monthly) and APL LIBRARY BULLETIN (weekly).

Information Services:

Responds to queries.

Remarks:

Integral unit of The Johns Hopkins University; operated under contract with U.S. Department of the Navy. Supported by U.S. Government. Staff: 1004 technical professionals, 122 administrative professionals, and 136 others.

Information Source:

U.S. Atomic Energy Commission
DIVISION OF TECHNICAL INFORMATION
Post Office Box 62
Oak Ridge, Tennessee 37832
Phone: (615) 483-8611, ext. 3-4352

Individual Contact(s):

Robert L. Shannon, Manager

Activities:

Atomic energy, reactor technology, radiation effects, nuclear physics, nuclear engineering, metallurgy, heat transfer and fluid flow, etc.

Holdings:

200,000 technical reports; 75,000 engineering drawings; 1200 journal subscriptions.

Publications:

NUCLEAR SCIENCE ABSTRACTS; technical reports in TECHNICAL PROGRESS REVIEWS (quarterly); bibliographies, translations.

Information Services:

Interlibrary loans; copying; distribution of educational booklets; literature searches.

Remarks:

Principal information center for the U.S. Atomic Energy Commission's research and development activities located at Oak Ridge National Laboratories, Oak Ridge, Tennessee.

Information Source:

Auburn University
Engineering Experiment Station
Auburn, Alabama 36830
Phone: (205) 826-4302

Individual Contact(s):

Dr. Vincent S. Haneman, Jr. - Director
Dr. William C. Johnson, Jr. - Assistant Director

Activities:

Performs basic and applied research in metallurgical engineering, brittleness of materials, and photoelasticity of pressure vessels.

Holdings:

Maintains a reference library as an integral part of the university library.

Publications:

Research results published in professional journals, bulletins, and project reports. Publication: ENGINEERING EXPERIMENT STATION BULLETIN (approximately ten times yearly).

Information Services:

Responds to research queries.

Remarks:

Integral unit of Auburn University. Supported by parent institution and contracts from government agencies and industry.

Information Source:

Garbell Foundation
1714 Lake Street
San Francisco, California 94121
Phone: (415) 752-0871

Individual Contact:

Dr. Maurice A. Garbell, President

Activities:

Principal fields of research: aeronautical sciences, including aerophysics, aeronautical engineering, aerodynamics, thermodynamics, and meteorology. Also provides consultation assistance in scientific research matters to U.S. Government and municipal government officials and a library exchange and reference service.

Holdings:

Maintains library of 5000 volumes on aerodynamics, aeronautical engineering, meteorology, space flight, and theoretical physics.

Publications:

Research project reports. Publication: GARBELL AEROSPACE SERIES (irregularly).

Information Services:

Publishes research results for sale.

Remarks:

Independent, nonprofit research organization with its own board of control. Supported by U.S. Government, founders, and trustees. Staff: 3 research professionals, 2 supporting professionals, and 1 other.

Information Center:

Georgia Institute of Technology
Engineering Experiment Station
Atlanta, Georgia 30322
Phone: (404) 894-3400

Individual Contact(s):

Dr. Maurice W. Long - Director
Dr. Rudolph L. Yobs - Assistant Director

Activities:

Performs basic and applied research in fracture mechanics, fatigue, life prediction of materials, and composite materials.

Holdings:

About 1 million books, reports, journals, periodicals, etc., are maintained by the G.I.T. library.

Publications:

Research results published in technical journals, bulletins, and special reports. Holds frequent conferences throughout the year.

Information Services:

Responds to research queries.

Remarks:

Integral unit of Georgia Institute of Technology. Supported by U.S. Government, state appropriations, industry, gifts, grants-in-aid, and income from endowments. Staff: 325 full-time and 375 part-time employees, including 80 graduate and 90 undergraduate student assistants. Technical reports of work accomplished are indexed and distributed by DDC.

Information Source:

Iowa State University
Structural Research Laboratory
Ames, Iowa 50010
Phone: (515) 294-7456

Individual Contact:

Dr. Wallace W. Sanders - Director

Activities:

Materials fatigue, structural engineering, design of structural materials, experimental, and theoretical analysis of structures.

Holdings:

Reports on governmental and university sponsored research in university library. Files not mechanized.

Publications:

Research results published in engineering journals and Research Institute publications.

Information Services:

Answers inquiries.

Remarks:

Integral unit of Engineering Research Institute at Iowa State University. Supported by parent institution, U.S. Government, and industry. Staff: 6 research professionals, 4 supporting professionals, 3 technicians, and 1 other.

Information Source:

Lehigh University
Institute of Fracture and Solid
Mechanics
Bethlehem, Pennsylvania 18015
Phone: (215) 691-7000, Ext. 376/720

Individual Contact:

Dr. George C. Sih - Director

Activities:

An area of special interest to the institute has been in fracture mechanics which deals with the study of structural and material sensitivity to flaws. Such flaws can seriously affect the design and strength of ships, aircrafts, automobiles, bridges, and buildings. In addition, fracture mechanics is finding application in such areas as bone fracture, environmentally enhanced cracking of pavements and structural members, the fracture of rocks, and the erosion of materials by solid or water particle impingement.

The institute centralizes many activities in the field of solid and fracture mechanics. These activities include: expansion of research capabilities to include the application of concepts of fracture mechanics to geology (rocks), medicine (bones), and composite materials; editing books on timely subjects in fracture and solid mechanics; compilation and collection of written materials to establish and maintain a special library of fracture mechanics; planning of conferences on fracture and solid mechanics; offering short courses and seminars on special topics; conducting a liaison program with industry and with government agencies.

Holdings:

About 50,000 volumes in the science library.

Publications:

Books, conference proceedings, technical reports, journal papers, etc. are edited and published by the members of the institute and they can be obtained upon request.

Information Services:

Responds to inquiries.

Remarks:

Integral unit of Lehigh University. Supported by parent institution, industry, and U.S. Government. Staff: 3 professionals, faculty members, and graduate students in various academic departments of the University.

Information Source:

Metals and Ceramics Information
Center
Battelle Memorial Institute
505 King Avenue
Columbus, Ohio 43201
Phone: (614) 299-3151, ext. 247.

Individual Contact:

H. Dana Moran - Director

Activities:

Performs research on the properties and processing of metals; refractory metals (columbium, tantalum, tungsten, molybdenum, chromium, vanadium, rhenium, and their alloys); platinum group metals; light metals (titanium, beryllium, magnesium, and aluminum); high-strength, high-temperature alloys; high-strength steels; corrosion and oxidation-resistant coatings.

Holdings:

Reports on Government sponsored research, books, journals, patents, data and trade literature.

Publications:

REVIEW OF RECENT DEVELOPMENTS (weekly); technical reports; selected accessions (monthly).

Information Services:

Answers inquiries; provides technical advisory services and information on current research and development in metals to producers and fabricators of defense metals, to Government agencies, and to institutions involved in the defense effort. Unclassified information files are accessible for on-site use.

Remarks:

The Center, operating under a Department of Defense contract, collects and analyzes information on metals and provides technical advisory services to the defense community.

Information Source:

Nondestructive Testing Information
Analysis Center
Army Materials and Mechanics
Research Center
Watertown, Massachusetts 02172
Phone: (617) 926-1900, ext. 552

Individual Contact:

Charles P. Mehrib - Director

Activities:

Performs nondestructive testing using radiography, ultrasonics, electro-magnetics, and other methods.

Holdings:

Estimated 7000 reports or abstracts on file. Files not mechanized. Reference library includes data, technical reports, standards, specifications, books, journals, magazines, standards, abstracts, and bibliographies.

Publications:

Newsletter; report guides to literature; abstracts indexes; bibliographies on nondestructive testing.

Information Services:

Answers inquiries; provides consulting or advisory services and literature-searching services; prepares analyses or evaluations.

Remarks:

Primary interest is in weapons such as guns and tanks. Research chiefly in metallurgy and quality assurance techniques. Files duplicated by DDC.

Information Source:

Northwestern University
Materials Research Center
Evanston, Illinois 60201
Phone: (312) 492-3606

Individual Contact:

Dr. Malcolm Dale - Chairman

Activities:

Basic and applied research in material sciences covering life prediction of materials, fracture toughness, and fracture mechanics.

Holdings:

Estimated 200,000 volumes in the technical and sciences library.

Publications:

Research published in project reports to sponsor, professional journals, and annual reports. Material usually submitted to DDC.

Information Services:

Responds to inquiries.

Remarks:

Integral unit of Technological Institute at Northwestern University. Supported by parent institution and U.S. Government. Staff: 2 professionals, 2 others, plus faculty members and graduate students in various academic departments of the University assigned to specific projects.

Information Source:

Nuclear Safety Information Center
Oak Ridge National Laboratory
Post Office Box Y
Oak Ridge, Tennessee 37830
Phone: (615) 483-8611, ext. 3-7253

Individual Contact(s):

William B. Cottrell - Director
Joel R. Buchanan - Assistant Director

Activities:

Maintains an information base on all aspects of nuclear safety: accident analysis; environmental surveys; monitoring and radiation exposure of man; siting and containment of facilities; transporting and handling of radioactive materials; reactor transients, kinetics, and stability; nuclear instrumentation; nuclear control and safety systems. Information base includes material properties, fracture mechanics and fracture toughness data of materials for reactor pressure vessels.

Holdings:

Mechanized reference file, indexed in depth, of information in the above areas; documents on nuclear safety, such as reactor safeguard reports.

Publications:

Publishes NUCLEAR SAFETY (quarterly); bimonthly bibliographies; state-of-the-art reports.

Information Services:

Answers inquiries; prepares special bibliographies; provides "current awareness" and consulting services. Documents are accessible for on-site use. Services are available to Government agencies, their contractors, research and educational institutions, and industry.

Remarks:

Operated by the Nuclear Division of the Union Carbide Corporation. Sponsored by the Division of Reactor Development and Technology, U.S. Atomic Energy Commission.

Information Source:

Southwest Research Institute
8500 Culebra Road
San Antonio, Texas 78206
Phone: (512) 684-2000

Individual Contact(s):

Martin Goland - President
Edwin Vaught - Librarian

Activities:

Nondestructive testing. Performs research on early evidences of fatigue; materials technology; structural engineering.

Holdings:

Maintains a library of 30,000 volumes on science and technology.

Publications:

Research results published in technical journals and project reports.
Publications: SCIENTIFIC LITERATURE CONTRIBUTIONS (annually), TOMORROW THROUGH RESEARCH (quarterly), and SOUTHWEST ROUNDUP (monthly). Holds periodic symposia and seminars as need requires.

Information Services:

Responds to queries.

Remarks:

Independent nonprofit research organization with its own board of control. Supported by U.S. Government and industry. Staff: 227 research professionals, 21 supporting professionals, 209 technicians, and 165 others.

Information Source:

Texas A&M University
Research Foundation
College Station, Texas 77843
Phone: (713) 845-7512

Individual Contact:

R. A. Schapery - Director, Mechanics and Materials Research Center

Activities:

Performs basic and applied research in structural mechanics, materials research; experimental mechanics; fracture mechanics; composite materials, and structural analysis.

Holdings:

In excess of 600,000 volumes are housed in a centrally located facility of which 350,000 are related to science and technology and 90,000 of these in engineering sciences.

Publications:

Research results published in professional journals and project reports.

Information Services:

Responds to research queries.

Remarks:

Integral unit of Texas A&M University. Supported by parent institution, federal, state, and industry funding.

Information Source:

Virginia Polytechnic Institute
and State University
College of Engineering
Blacksburg, Virginia 24061
Phone: (703) 951-6643

Individual Contact(s):

Dr. Daniel Frederick
Dr. Jack L. Lytton
Dr. Kenneth I. Reifsnider

Activities:

Performs research on various aspects of behavior of composite materials including low cycle fatigue data; thermal stress analysis; fracture mechanics of ductile and brittle materials; crack propagation under fatigue; three-dimensional studies of fracture mechanics of cracks in plates; studies on delaminations; finite element and numerical analyses; analysis of metallic diffusion; hydrogen embrittlement; and stress-corrosion cracking.

Holdings:

Reports on governmental and university sponsored research, books, journals, university reports, data, and computer programs.

Publications:

Reports (technical) issued by departmental faculty also reprints of papers published in journals.

Information Services:

Answers inquiries.

Remarks:

Regular College of VPI and SU. Research supported by U.S. Army Office of Research and Engineering, NASA, U.S. Air Force, AEC, and VPI and SU.

Information Source:

University of California
Structural Engineering Materials
Laboratory
Berkeley, California 94720
Phone: (415) 642-6463

Individual Contact:

Professor Milos Polivka - Vice Chairman of Laboratory

Activities:

Structural materials; mechanics of structural failure; structural analysis and design; mechanics of deformable bodies and experimental stress analysis; behavior of structures in plastic range; use of computers in structural analysis.

Holdings:

Maintains a reference library on structures and materials.

Publications:

Research results published in technical journals and project reports.
Publication: STRUCTURES AND MATERIALS RESEARCH REPORTS (irregularly).

Information Services:

Responds to queries.

Remarks:

Integral unit of College of Engineering at University of California at Berkeley. Supported by parent institution, U.S. Government, and industry.
Staff: 22 research professionals and 13 technicians.

Information Source:

University of Minnesota
Space Sciences Center
Minneapolis, Minnesota 55455
Phone: (612) 373-5479

Individual Contact:

Dr. Lawrence J. Cahill - Director

Activities:

Performs research in space related sciences.

Holdings:

Maintains a reference library on structures and materials.

Publications:

Research published in professional and technical journals.

Information Services:

Responds to queries.

Remarks:

Integral unit of University of Minnesota. Supported by U.S. Government.

Information Source:

University of Missouri at Rolla
Graduate Center for Materials
Research
Rolla, Missouri 65401
Phone: (314) 364-6027

Individual Contact(s):

Dr. W. J. James - Director
Dr. M. E. Straumanis
Dr. J. W. Johnson

Activities:

Performs research in materials science and defect structures studies. Research areas include hydrogen embrittlement of steel; protective coatings and oxides; electrochemical corrosion of aluminum, zinc, and beryllium in aqueous and non-aqueous environments.

Holdings:

Reports on governmental and university sponsored research, books, journals, and standard engineering reference library.

Publications:

Research results published in scientific journals and technical reports.
Holds annual symposium on materials science.

Information Services:

Responds to queries.

Remarks:

Integral unit of Space Sciences Research Center at University of Missouri (see listing above), located on Rolla campus of the University. Supported by parent institution, and U.S. Government and industry. Staffs 4 research professionals, 8 research associates, 2 technicians, 22 graduate student assistants, and 3 others.

Information Source:

University of Tennessee
Space Institute
Tullahoma, Tennessee 37388
Phone: (615) 455-0631

Individual Contact(s):

Dr. Bernhard H. Goethert - Director
Dr. Maurice A. Wright

Activities:

Performs research on fracture toughness of boron-aluminum composites; effects of elevated temperatures on structural properties of fiber composite materials; effects of cyclic temperature changes on mechanical properties of various composite materials; and application of the principles of linear elastic fracture mechanics. Investigates the fatigue properties of fiber-reinforced, plastic-matrix structural materials.

Holdings:

Maintains a reference library on composite materials.

Publications:

Research results published in technical journals and project reports.

Information Services:

Responds to queries.

Remarks:

Integral unit of Graduate School of University of Tennessee. Research supported by parent institution, industry, and U.S. Government.

Information Source:

University of Virginia
Research Laboratories for the
Engineering Sciences
Thornton Hall
Charlottesville, Virginia 22903
Phone: (703) 293-9765

Individual Contact:

Dr. George A. McAlpine - Director

Activities:

Perform basic and applied research in materials including fracture toughness and life prediction of materials.

Holdings:

Engineering library maintains 45,000 books and volumes, 850 periodicals, and undisclosed number of unbound NACA reports.

Publications:

Research results published in professional journals and special technical reports.

Information Services:

Responds to queries.

Remarks:

Integral unit of School of Engineering and Applied Science at University of Virginia; outgrowth of Ordnance Research Laboratory established in 1944 and Engineering Experiment Station established in 1951. Supported by parent institution, U.S. Government, and industry. Staff: 55 research professionals, 58 supporting professionals, 17 technicians, and 27 others.

Information Source:

University of Washington
Department of Mechanical Engineering
Seattle, Washington 98195
Phone: (206) 543-5090

University of Washington
Department of Mining, Metallurgical,
and Ceramic Engineering
Seattle, Washington 98195
Phone: (206) 543-2600

Individual Contact(s):

Dr. Thomas F. Archbold, Professor of Metallurgical Engineering
Dr. Ashley F. Emery, Professor of Mechanical Engineering
Dr. Albert S. Kobayashi, Professor of Mechanical Engineering
Dr. William J. Love, Professor of Mechanical Engineering
Dr. Douglas H. Polonis, Professor of Mineral Engineering
Dr. Raymond Taggart, Professor of Mechanical Engineering
Dr. Reid Parmerter, Associate Professor, Aeronautics & Astronautics

Activities:

Basic and applied research in material sciences covering life prediction of materials, fracture toughness, fracture mechanics, failure analysis, and design against failure. "Traditional and nontraditional engineering materials including ice."

Holdings:

Estimated 60,000 volumes in the Engineering Library.

Publications:

Research published in project reports to sponsor, professional journals, and annual reports.

Information Services:

Responds to inquiries.

Remarks:

Supported by parent institution and the U.S. Government. Staff: 7 faculty members and over 20 graduate students in the above two departments are assigned to various sponsored and unsponsored projects.

Information Source:

University of Wisconsin
Engineering Experiment Station
1513 University Avenue
Madison, Wisconsin 53706
Phone: (608) 263-1600

Individual Contact(s):

Dr. Camden A. Coberly - Executive Director
Dr. W. R. Marshall, Jr. - Dean, College of Engineering
L. G. Zweifel - Librarian

Activities:

Performs research on metals, structural engineering, and the effects of environment on properties of materials.

Holdings:

Library of 50,000 books and 35,000 periodicals in all fields of engineering.

Publications:

Research results published in engineering and scientific journals.
Publication: ANNUAL REPORT. Maintains a library of 50,000 books and 35,000 periodicals in all fields of engineering.

Information Services:

Responds to queries.

Remarks:

Integral unit of College of Engineering at University of Wisconsin.
Supported by parent institution, U.S. Government, state funds, industry, and foundations, including Wisconsin Alumni Research Foundation. Staff: 110 research professionals, 350 supporting professionals and graduate students, 20 technicians, and 20 others.

Information Source:

Watervliet Arsenal
Technical Information Services Office
Attention: SWEWV-RDT
Watervliet, New York 12189
Phone: (518) 273-4610, ext. 5500

Individual Contact(s):

Dr. R. E. Weigle - Director of Research and Engineering
Dr. F. W. Schmiedeshoff - Director of Research
Dr. Thomas Davidson - Director of Materials Engineering

Activities:

Performs basic and applied research in structural mechanics of fatigue, crack propagation, fracture mechanics; solid state physics; ultra-high pressure alloys; deformation mechanisms; defect behavior; ferrous metals; Powdered metals; heat and erosion resistant materials; vacuum melting of alloys; metal-forming, cutting, and machining; diffusion; heat-treating; surface finishing; casting; plating; welding; and shot-peening.

Holdings:

Over 6,000 books, 300 periodical titles, and 20,000 technical reports; vendors catalog microfilm file.

Publications:

Technical reports, directories, abstracts, indexes, specifications, and accession lists.

Information Services:

Answers inquiries; makes referrals; provides reference, literature-searching, abstracting, and reproduction services; makes interlibrary loans. The literature collections are accessible for on-site use by prior arrangement.

Remarks:

Reports are submitted to DDC for indexing and distribution. The TISO does not publish a bibliography.